

# RISK MANAGEMENT APPROACHES IN OIL AND GAS ONSHORE CONSTRUCTION PROJECTS (PROJECT MANAGEMENT)

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## Abstract

*Risk management is a vital decision making process useful for the successful delivery of projects. However, the full practice is still not often carried out during the project implementation. This research has to determine the suitable risk response, mitigation action plan and show the difference between approaches of project risk awareness. Research shows two approaches in the preparation/execution of the project: comprehensive, general risk awareness and the minimum emanate risk knowledge. This paper will not focus on the engineering staff training, partnering and contractor selection. This paper shows risk management practices, risk and analysis methods, and contingency mitigations approaches for the major project elements.*

**Keywords:** common risk management, mitigation, contingency practices, risk and analysis method

## 1. INTRODUCTION

What is risk management? Risk management refers to a coordinated set of activities and methods that are used to direct an organization and to control the many risks that can affect its ability to achieve certain objectives. Risk management has to answer on how it intends to manage such risk by systematically applying management policies, procedures, applying management components, approaches and resources that will be used [1].

The purpose of this research is to identify the major risks management approaches affecting oil and gas overhaul construction projects from the point of the preparation phase through until the execution phase. Research presents utilization of the contingency reserves through different mitigation decisions where an approach was taken for the lower contingency and higher contingency reserves. A case study approach was used and carried throughout the two top projects working in the Croatian oil and gas overhaul construction organization to provide and also to identify the major risks that emanate on oil and gas projects via risk management analysis. We will presume that derived strategies are in alignment with the project needs. Two similar projects were chosen for the comparison between the risk assessment methodology approaches.

The research questions are: if different risk and analysis approaches were used, how that will affect contingency decisions and how diligent risk management awareness decreases total classification of the risk as well the final optimistic mitigation cost. Our hypothesis is: there is a significant difference in the project contingency when two different risk management approaches (detailed, less detailed) were taken on complex projects. By these presented case studies in Figure 1 and Figure 3, comprehensive risk assessment approach vs. general optimistic approach proves the difference between low/high risk exposures and contingency plans.

Risk analysis scope of the two projects concentrates primarily on the projects' risks to the sequence of the typical project process in oil and gas onshore overhaul construction: observing project, initial strategic preparation, estimation and creating bill of quantities (BOQ), schedule of execution, material, labor cost, overhead cost, project execution, close outs. Each one of the initial preparations has risk associated elements and all leads to the performance, project quality, period of performance (POP) and the budget, including the contingency cost and all risks (contingencies, uncertainties) [2]. All addressed major risk classifications and assessment approaches are described in the section 3.1. Risk analysis scope presented in case study 2 shows the common definition of risk approach from the perspective of the general benchmark prediction that project success can be justified from the prospective of the contingency reserves.

Risk project management in general is divided into five stages: establishing the project concept, risk identification, risk analysis, risk evaluation and risk mitigation [3]. So from the detailed or quantified approach, risks could be avoided, retained, reduced and transferred by suitable techniques in carrying risk management practices

## 2. METHODOLOGY

For the purpose of this paper, the case study research method was used where two onshore major overhaul projects were analyzed. As already mentioned in the introduction section, the data collection and analysis approach was taken only for the preparation/execution phase. Case studies were analyzed in following 3 steps: (1) short introduction to the project was given, (2) methodology matrix of the particular risk assessment process was shown and (3) a risk category map was made. The methodology matrix tool shown in Figure 1 and Figure 3 is presenting two approaches of the risk management and mitigation strategy used in a distinct project. Methodology matrix in Figure 1 is presenting the full approach of the risk & analysis management whereas the Figure 3 shows the slight deviation methodology approach. The risk category map show in Figure 2 is presenting 10 major group risk categories with the probability matrix described from risk level (1-5) and Figure 4 consists of 7 major group risk categories with the probability matrix described from (1-5) from the low-low / low / medium / high / high-high risk level.

## 3. CASE STUDY

The reasons why analysis for this paper was taken on these two cases was that both of the cases were prepared and executed in Croatia, the scope and investment limitation were taken from the same initial planning preparation approach, and the period of execution was done in the same time frame and with the most of the needed resources were found in house. Different risk management and analysis was conducted on these two projects, where we have the same needs for the overhaul, investment and quality/budget/time criteria but with different aspect of the risk assessment. These case studies will be elaborated in the detail. Most of the risks assessment is related to the preparation/execution phase especially in the segment of contingency, budget, quality and the activities planned durations. The simple approach was taken in both projects. The risk profile was segregated into group's activities: schedule, cost, quality and performance. MS Project was used for the purposes of the scheduling while risk workshop was used as a kickoff to launch the risk and analysis approach. The standard identification and mitigation template contents were used in the risk management tools; early defined matrix of the cost and probability matrix. Where it leads us to the final project results whole risk management picture, contingency allocation and final contingency spending.

### 3.1 Case study risk management and fast track project 1

Project risk management was well performed on the existing project. Identification of all major risks that emanated on the oil and gas projects was conducted via risk management analysis, risk assessment process and risk category map. In the early stage of project preparation, an initial risk assessment was conducted where it came to the agreement that risk management is needed. All project-related conditions that have the capability to prevent the impact of undesirable consequences on projects goals were conducted to uncover the weaknesses in development phase as in execution phase in a way of:

- initiating timely mitigation actions
- reducing the impact of the risks.

Final consensus is that all risks can be effectively mitigated or addressed by using all of following ways:

1. Reducing or eliminating the risks by including the early risk and analysis approach. Detailed preparation of the mitigation strategy and contingency plan are applied to all project segments: (9) financial, (8b) political, (1a) operational, (1) project management risks, (10a) environmental, (2) construction, (4) supply chain risks, (2a) commissioning, (10) HSE, (8) legal, (5) design, (7) weather related risks, (6) third party, (3) subcontractors, (8a) contract).
2. Risk flow down strategy (8) transferring the risk to other responsible parties.



**Figure 1** – Representation of risk management process [4,5]

Figure 1 represents the overall risk assessment process used in this project. The system was based on the sub-processes level as follows: launching risk system, identifying risk, consultation and communication among the Functional Area Managers (FAMs) and then analyzing the risk, evaluating risk, treating risk, preparing the contingency report and lastly, controlling and monitoring risk related events. If there is deviation from the controlling measures, the risk has to go through the process as shown in the Figure 1 [4,5]. In order to identify various risk categories to enable a design of an effective risk classification system for construction projects, the recommendation was to allocate the risks based on their consequences on a project, through approach of the risk source allocation and the level of knowledge. Each one of them needs to have minimum requirement of [5]: known knowns, known unknowns, unknown known and unknown unknowns. Benefit achieved through the process was that risk is treated from the probability of risk occurring. Also, the communication approach with the FAMs is differentiating the risks with respect to the:

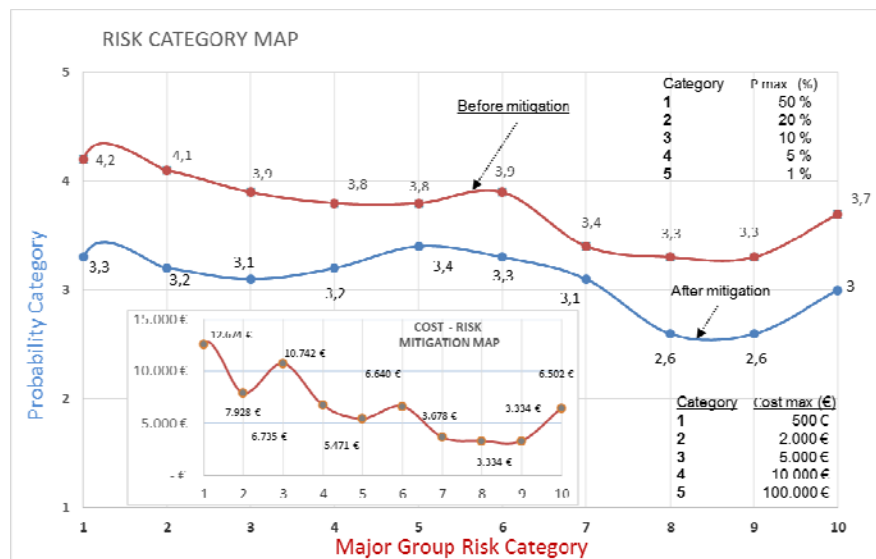
- “risk level” within projects or an organization gives a true perspective and exact nature of the risk,
- perspective of the risks, the origin of the risks, and finally the risk dependency to other risks.

### 3.2 The risk register of case study 1

As previously stated, the primary aim of the risk system is to start with identification phase to generate a risk register of project specific risks per segments and the risk map described in the case study 1. For the case study 1, the risk register contains a list of more or less standard risks that are used in all overhaul construction projects, including the applicable risks for the particular deviation segments of the project and outside drivers. In detail, constructed comprehensive list of all risks has been identified with over 100 potential risky events. The risk register segregates an extensive identification of critical risks, giving the risk associated category levels to each one of them. The risk register focused to narrow approach of the realistic risk with the recommendation of the subject matter, consultation experts as well as the FAMs. The identification process approach shown in case study 1 has important priority by providing resources for all phases of the assessment and actions, by this it was achieved narrow critical risks register without any missing elements in the process. If noncritical risks are identified and some of the most critical risks are missed, the risk analysis approach can give the wrong leads to decision makers where the risk register will be treated as misled.

Confirmed narrow risk register and given risk analysis pathway was based on a process of making decision between the three critical impacting factors: cost, schedule and quality. The objective of the risk analysis described in case study 1 was to minimize all the estimated risks, but to ensure that estimated risk associated cost of implementing those risks correspond with the project factors: cost, schedule, quality and also meeting the estimated approved budget requirements and guarantee the cost of implementing each risk response strategy is not doubled through the contingency approach. In case that the risk is monitored and cannot be solved, risk was returned to the risk assessment but without impact on the all three factors. Critical constraint

ensures that each work activity is finished in estimated time or at least will not affect the start as scheduled of its successors and that (EA) each work activity preserves a level of quality or at least match the minimum standard on the base that will not affect the normal construction of its successors. In the case study 1 the performance quality expected under the normal conditions is assumed to be at 90% level for each activity.



**Figure 2** – Risk category map showing the contingency realization

Presented Figure 2 was based on selected risk response strategies by maximizing risk response effects of implementing the mitigation factors. Combined chart is showing the 10 major group risk categories with the probability matrix described from (1-5) from the low-low / low / medium / high / high-high risk level [6,7]. After the risk assessment was applied, the following steps presented in Figure 1, mitigation curve was moved to the lower level of the potential risks and some associated probability cost was added. By this approach it is clear that the comprehensive approach was taken from the prospective of the risk management where the mitigation was done diligently and immediately showed progress in the risk flow level. A contingency was built on the level that minimum cost (cost table in % 1 to 5 vs probability table in %) will be associated due to the good mitigation strategy.

### 3.3 Case study risk management and fast track project 2

Project risk management was partially performed on the existing project. Some of the project aspects presented in Figure 2 went through the risk and analysis preparation and on the most of them seem to come to the same agreement as in case study 1. The result that risk management is about finding the sources of risks on projects and determining methods to lean toward the common practices by which missing steps can be mitigated on projects by contingency approach. In case study 1, all project-related major group risk categories were presented, where they were threatened through the full risk assessment whereas in the case study 2 conditions of the major group risks category were reduced.

Figure 3 represents the risk reduced assessment process. The system is established on the level of the few basic sub-processes where approach of the controlling the risk was taken from point of the huge contingency reserves with case that majority identified risks occurs [4,5]. Certain elements appearing in procedure 1 (Figure 1) were left out in procedure 2 (Figure 3) due to the past performance experience, needed fast track tempo in the preparation/execution phase and general risk approach. The next stage was to determine whether this will be carried out by qualitative or quantitative means by standard common risk matrix and past experience. In order to stay with the reduced risk categories approach, the recommendation was that most of the general risks should be allocated on risk categorization per the level of knowledge. As knowledge decision is proposed, taking the risk & analysis assessment method approach by quantitative general model and selective qualitative analysis in the selected risk areas by contributing missing assessments by contingency incense. In the case study 2, a model is constructed based on knowledgeable qualitative analysis, where the contingency was taken to compromise the unforeseeable types of risks that relates to imposed or planned changes which occur on projects as arises due to external and internal forces. As one of the crucial links was the knowledge risks approach used in some risk system areas where we had

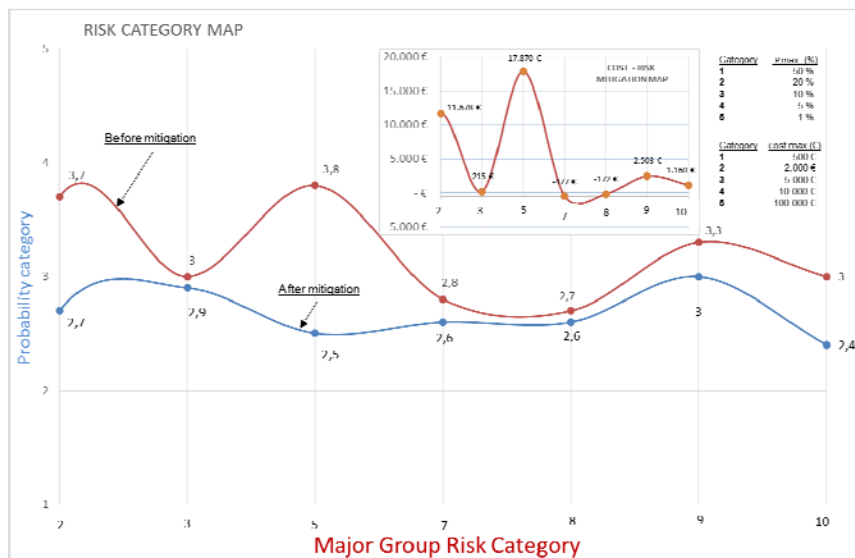
risk of the key personnel leaving the project is the great risk to the existing general quantitative approach assessment. This concept is based on the obvious fact that the longest possible time required for the project completion, and limited resources with the lower performance knowledge and quality will have to deal with the risk management approach in case study 2.



**Figure 3** – Representation of reduced risk management process [4,5]

### 3.4. The risk register of Case study 2

Per the above risk category map (Figure 4) it is clear that in the groups (2) and (5) big contingency is captured, due to the reduced risk management process (Figure 3). The overall repercussion of the contingency allocation between the groups is showing knowns, but for the three groups (4), (1), (6) contingency was taken based on the average percentage safety contingency. Presented Figure 4 was based on selected general risk response strategies by risk coping capacity with a paired effect on success. Response effects of implementing the mitigation while considering project cost of strategies, project schedule and project quality were done through the major general group risks categories with the probability of maximizing associated probability cost.



**Figure 4** – Risk category map showing the contingency realization

Combined chart is showing the 7 major group risk categories [6,7]. After the reduced risk assessment was applied following steps presented in the Figure 3, the mitigation curve was slightly moved to the lower level of the potential risks where associated probability cost was added. The approach for the missing three risk category groups (4), (1), (6) third party external group was based on best knowledge and past experience. All other group assessments were done on the best practice knowledge. By this approach, it is clear that comprehensive approach is missing from the prospective, where it can be seen even that mitigation factors

were not taken into account as a possible solution instead all of the risk groups contingency was built on the level standard data. General risk and large associated risk cost (cost table in % vs probability table in %) were reserved in case that all risks occurs. In case study 2, the performance quality expected under the normal conditions is assumed to be at 80% level for each activity.

#### 4. CASE STUDY RESULTS

The paper revealed that the concept of risk management is essential for the successful planning and execution of the projects and needs to be routine so that companies can meet with their objectives of cost, time and quality with the respect to the minimum requirements and nature of projects. This chapter summarizes the most important conclusions from the performed two case studies. In the case study 1 department's risk management and analysis practices are formalized and effectively performed. Their practices comply with the established internal documentation and routines. The company has a structured method to identify risks, where the departments risk analysis is carried out in a deterministic approach, where identified risks are assessed by the estimation responsible or jointly by the FAM's team in a risk meeting. During the meetings, both threats and opportunities are assessed but with a clear focus on the threats. The valued risks with substantial impact are recorded in a risk register, where threats and opportunities are mixed. The unidentifiable risks as well as the risks with minor impact are covered with a contingency cost, which complements the risk register. In case study 1, 60 percentage of the contingency was saved in other words, funds were not used and all deadlines were achieved. The findings also suggest that both risk no transparency and risk coping capacity have a direct impact on project portfolios success. Also in case 2, the contingency cost is assessed in an informal manner based on experiences and a gut feeling. Major risk category areas were missed during the assessment based on the general approach. Misleading and missing steps in process were defined as competence risks where the risks occur due to poor project management competency. Inefficient communication between the FAM's in any stage of the project or risk assessment can leads to misunderstandings and errors. In case study 2, 80 percent of the contingency was used to achieve all deadlines. On the contrary, in case study 1, regardless of the past experience, the quantitative approach was carried out by statistical analysis of historical data for the exact condition with prediction of risk events and determination of risk parameters.

#### 5. CONCLUSION

Taking into consideration the two risk management approaches for the mentioned case studies, it was concluded that companies use a common best practice risk management and analysis approach definition. Findings show that organizations' or companies' knowledge or even their best practices have to have some risks benchmarks and standard practice so that when a risk event occurs, that incorporated mitigation options and chosen risk analysis plans produce the most suitable solution. Definition of determination and measurement magnitude, consequence and probability of risk events totals up to usage of risk magnitude. This vital common risk definition approach eliminates misunderstandings and confusion during the risk management process. Comparison of the cost resources vs. cost of the not identifying potential risks has large negativity on the project organization. Therefore the basic functions which constitute the methodology of risk analysis or assessment has to be used on most of the complex projects. Detailed quality approach of department risk management process was associated with the risk adversity vs. knowledge quantity/experience with very restrictive risks approach. Adopting a thorough convenient approach by using the best knowledge, quality and full detailed risk management assessment approach, manages threats and opportunities in a way that decreases contingency usage. Consequence shows that projects capturing risks must be effectively structured to be able to avoid increase in contingency. The minimum past experience improvements in risk analysis/quantification and implementation of a risk best practice structure needs to use the common risk approach. Today's market, both externally and internally, is changing rapidly. Consequently, a risk flexible common structure which will provide enough insights of a projects risk exposure is required. The common structure separates threats from opportunities by using two risk registers. Connecting the common present risk register with the register of the new project approach is called continuous risk management. This approach drives continuous risk management process towards a more probabilistic one. However, the results confirmed that there is a significant difference in the project contingency when two different risk management approaches were taken, thus further research should be developed for the less complicated projects using the approach 2 in other to explore if they can result with a lower contingency.

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